ATTACHMENT 8

SPECIAL CONDITIONS RATIONALE

VPDES PERMIT PROGRAM
LIST OF SPECIAL CONDITIONS RATIONALE

Name of Condition:

B. ADDITIONAL TOTAL RESIDUAL CHLORINE (TRC) LIMITATIONS AND MONITORING REQUIREMENTS

Rationale: The State Water Quality Standards, 9 VAC 25-260-160 (Fecal coliform bacteria; shellfish waters) and 9 VAC 25-260-170 (Bacteria; other waters) address bacterial standards in surface waters and sewage discharges. These internal limitations and monitoring requirements are designed to achieve those water quality standards. In addition, 40 CFR 122.41(e) requires the permittee, at all times, to properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) in order to achieve compliance with the permit (includes laboratory controls and QA/QC). This requirement will also insure both continued proper operation of the chlorination facilities and maintenance of a minimum level of chlorine in order to achieve adequate disinfection.

C. OTHER REQUIREMENTS OR SPECIAL CONDITIONS

1. Permit Reopeners

a. Sludge Reopener

Rationale: Required by the VPDES Permit Regulation, 9 VAC 25-31-220 C., and 40 CFR 122.44(c)(4), which note that all permits for domestic sewage treatment plants (including sludge-only facilities) include any applicable standard for sewage sludge use or disposal promulgated under section 405(d) of the Clean Water Act.

b. Water Quality Criteria Reopener

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-220 D., Water Quality Standards and State Requirements, requires that the permit include limits to achieve water quality standards, including the narrative criteria. 40 CFR Part 131, Water Quality Standards, requires the state to adopt water quality criteria to protect designated water uses (subpart 131.11), and review, modify and adopt water quality standards periodically (subpart 131.20). Section 302 of the Clean Water Act authorizes effluent limitations to be established which will contribute to the attainment or maintenance of the water quality.

c. Chesapeake Bay Nutrients Reopener

Rationale: Significant portions of the Chesapeake Bay and its tributaries are listed as impaired on Virginia's 303(d) list of impaired waters for not meeting the aquatic life use support goal, and the 2004 Virginia Water Quality Assessment 305(b)/303(d) Integrated Report indicates that 83% of the mainstem Bay does not fully support this use support goal under Virginia's water quality assessment guidelines. Nutrient enrichment is cited as one of the primary causes for impairment.

d. General Permit Controls

Rationale: The Virginia General Assembly, in their 2005 session, enacted a new Article (4.02 Chesapeake Bay Watershed Nutrient Credit Exchange Program) to the Code of Virginia to address nutrient loads to the Bay. Section 62.1-44.19:14 of the law requires the development of a watershed general permit that authorizes point source discharges of total nitrogen and total phosphorus and provides for the control of those nutrients in lieu of the individual VPDES permits, unless the individual permits contain more restrictive limits that are necessary to protect local water quality. That section of the law also sets forth various items to be contained within the general permit. Section 62.1-44.19:15 sets forth the requirements for new and expanded dischargers which are captured by the requirements of the law.

e. Total Maximum Daily Load (TMDL)] Reopener

Rationale: Section 303(d) of the Clean Water Act requires that total maximum daily loads (TMDLs) be developed for streams listed as impaired in order that they achieve the applicable water quality standards. This condition allows for the permit to be either modified or, alternatively, revoked and reissued to bring it into compliance with any applicable TMDL approved for the receiving stream. The reopener recognizes that, according to section 402(o)(l) of the Clean Water Act, limits and/or conditions may be either more or less stringent than those contained in this permit. Specifically, they can be relaxed if they are the result of a TMDL, basin plan or other waste load allocation prepared under section 303 of the Act.

2. Licensed Wastewater Operator Requirement

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-200 D., requires the permittee to employ or contract at least one wastewater works operator who holds a current wastewater license for the permitted facility. The Code of Virginia 54.1-2300 et seq., Rules and Regulations for Waterworks and Wastewater Works Operators (18 VAC 160-20-10 et seq.) requires licensure of operators. In addition, the Sewerage Collection and Treatment Regulations (12 VAC 5-581-10 et seq.), recommends a manning and classification schedule for domestic wastewater treatment plant operators, based on plant capacity and specific treatment types.

3. Reliability Class

Rationale: The Sewerage Collection and Treatment Regulations (12 VAC 5-581-10 et seq.) specify reliability classes for all domestic sewage facilities.

4. Certificate to Construct (CTC) and Certificate to Operate (CTO) Requirements

Rationale: The Sewerage Collection and Treatment Regulations (12 VAC 5-581-10 et seq.) specify the requirement for the review and approval of plans and specifications (CTC) and the subsequent issuance of a CTO prior to operating any domestic sewage facilities.

5. Operations & Maintenance (O&M) Manual Requirements

Rationale: Required by the State Water Control Law, Section 62.1-44.19 and the VPDES Permit Regulation, 9 VAC 25-31-190 E. The State Water Control Law, Section 62.1-44.21, allows requests for any information necessary to determine the effect of the discharge on state waters. Section 401 of the Clean Water Act requires the permittee to provide opportunity for the state to review the proposed operations of the facility. In addition, 40 CFR 122.41(e) requires the permittee, at all times, to properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) in order to achieve compliance with the permit (includes laboratory controls and QA/QC).

6. 95% Design Capacity Notification

Rationale: Required by the VPDES Permit Regulation, 9 VAC 25-31-200 B.2., for all POTWs and PVOTWs in order to insure continued compliance with the terms of the permit.

7. Compliance Reporting Under Part I.A.

Rationale: Authorized by the VPDES Permit Regulation, 9 VAC 25-31-190 J.4. and 220 I. This condition is necessary when toxic pollutants are monitored by the permittee and a maximum level of quantification and/or a specific analytical method is required in order to assess compliance with a permit limit or to compare effluent quality with a numeric criterion. The condition also establishes protocols for calculation of reported values.

8. Materials Handling and Storage

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-50 A., prohibits the discharge of any wastes into State waters unless authorized by permit. The State Water Control Law, Sec. 62.1-44.16 and 17 authorizes the Board to regulate the discharge of industrial or other wastes. Section 301 of the Clean Water Act prohibits the discharge of any pollutant unless it complies with specific sections of the Act.

9. Water Quality Monitoring

Rationale: The State Water Control Law, Section 62.1-44.21, authorizes the Board to request information needed to determine the discharge's impact on State waters. States are required to review data on discharges to identify actual or potential toxicity problems, or the attainment of water quality goals, according to 40 CFR Part 131, Water Quality Standards, subpart 131.11. To insure that water quality criteria are maintained, the permittee is required to analyze the facility's effluent for the substances noted in Attachment A of the permit.

10. Ground Water Monitoring Plan

Rationale: The State Water Control Law, Section 62.1-44.21, authorizes the Board to request information needed to determine the discharge's impact on State waters. Ground water monitoring for parameters of concern will indicate whether the system integrity is being maintained and will determine if activities at the site are resulting in violations of the State Water Control Board's Ground Water Standards.

11. Indirect Dischargers

Rationale: Required by the VPDES Permit Regulation, 9 VAC 25-31-200 B.1 and 40 CFR 122.42(b), for POTWs and PVOTWs which receive waste from someone other than the owner of the treatment works. DEQ must be notified of the introduction of new pollutants to the treatment system, from an indirect discharger, whether as increased volume or a change in the character of the pollutants.

12. Minimum Freeboard

Rationale: Minimize the discharge of untreated wastewater to the groundwater or surface waters.

13. Facility Closure Plan

Rationale: This condition is required in the event that some or all of the operations at the facility cease. The system (or part of the system) must be properly closed out in accordance with regulatory requirements.

14. Nutrient Reporting Calculations

Rationale: Guidance Memorandum 05-2009 implements DEQ's best professional judgment decision to limit nutrient loadings from facilities listed on the Chesapeake Bay Program Significant Discharger List. The guidance memorandum provides the basis for this decision and specifies the procedure for determining annual effluent limitations for these parameters for each affected facility.

15. Suspension of Nutrient concentration limits for E3/E4 facilities

9 VAC 25-40-70 B authorizes DEQ to approve an alternate compliance method to the technology-based effluent concentration limitations as required by subsection A of this section. Such alternate compliance method shall be incorporated into the permit of an Exemplary Environmental Enterprise (E3) facility or an Extraordinary Environmental Enterprise (E4) facility to allow the suspension of applicable technology-based effluent concentration limitations during the period the E3 or E4 facility has a fully implemented environmental management system that includes operation of installed nutrient removal technologies at the treatment efficiency levels for which they were designed.

16. Permit Application Requirement

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-100 D. and 40 CFR 122.21 (d)(1) require a new application at least 180 days prior to expiration of the existing permit. In addition, the VPDES Permit Regulation, 9 VAC 25-31-100 E.1. and 40 CFR 122.21 (e)(1) note that a permit shall not be issued before receiving a complete application.

D. SIGNIFICANT DISCHARGE WASTE SURVEY

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-10 et seq., Part VII, and 40 CFR Part 403 establish the legal requirements for State, local government and industry to implement National Pretreatment Standards. The Pretreatment Standards are implemented to prevent POTW plant pass through, interference, violation of water quality standards or contamination of sewage sludge. The regulation requires POTWs with a total design flow greater than 5 MGD with significant or categorical industrial input to establish a Pretreatment Program. The regulation also may apply to POTWs with design flows less than 5 MGD if circumstances warrant control of industrial discharges.

This survey is designed to determine if there are any significant or categorical industrial users discharging into the POTW' collection system. Based on the survey results, a determination can be made as to the need for establishing a pretreatment program at the POTW.

E. TOXICS MANAGEMENT PROGRAM (TMP)

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-210 and 220 I., and 40 CFR 122.44(d) require monitoring in the permit to provide for and assure compliance with all applicable requirements of the Clean Water Act and the State Water Control Law. See additional justification included in this attachment.

F. SEWAGE SLUDGE USE AND DISPOSAL, LIMITATIONS AND MONITORING REQUIREMENTS

Rationale: The VPDES Permit Regulation, 9 VAC 25-31-100 P., 220 B.2. and 420 through 720, and 40 CFR 503 require all treatment works treating domestic sewage to submit information on sludge use and disposal practices and to meet specified standards for sludge use and disposal. The VPDES sewage sludge permit application form and its attachments constitute the sludge management plan and will be considered for approval with the VPDES permit. Technical requirements may be derived from the Department of Health's Biosolids Use Regulation, 12 VAC 5-585-10 et seq. and sections 330 and 340 of that regulation specify the general purpose and control requirements for an O&M manual in order to facilitate proper O&M of the facilities to meet the requirements of the regulation.

Part II CONDITIONS APPLICABLE TO ALL VPDES PERMITS

The VPDES Permit Regulation, 9 VAC 25-31-190, and 40 CFR 122, require all VPDES permits to contain or specifically cite the conditions listed.

MEMORANDUM

VIRGINIA DEPARTMENT OF ENVIRONMENTAL QUALITY
Blue Ridge Regional Office – Lynchburg
WATER DIVISION

7705 Timberlake Road Lynchburg, VA 24502

SUBJECT: FARMVILLE ADVANCED WWTP, VPDES PERMIT # VA0083135, TOXICS MANAGEMENT PROGRAM DATA REVIEW

TO: Kip Foster, Water Permits Manager - BRRO

FROM: Kirk Batsel, Sr. Environmental Engineer - BRRO

DATE: December 8, 2009

COPIES: Permit file

General Background

The subject facility's VPDES permit is currently being reissued. As part of the reissuance, toxicity data generated during the current permit term is evaluated. The facility, a municipal major, is currently required to conduct annual chronic toxicity tests using both an invertebrate (*Ceriodaphnia dubia*) and vertebrate (*Pimephales promelas*) indicator organism. In accordance with permit requirements, the facility generated 4 sets of chronic toxicity tests. This also satisfies the Form 2A application requirements. Please refer to Table 1 for results of tests generated during the current permit term.

Table 1. Chronic Toxicity Test Results for Farmville WWTP; VA0083135, Outfall 001

Date of test	Invertebrate NOEC %	Vertebrate NOEC %	Survival in 100% effluent	Testing Laboratory
6/14/05	40 (Reproduction)	100	90% C.d. 95% P.p.	CBI
3/27/06	100	100	90% C.d. 88% P.p.	CBI
3/19/07	100	100	90% C.d. 100% P.p.	CBI
4/14/08	32(Reproduction)	32 (Growth)	70% C.d. 100% P.p.	Olver
4/20/09	32(Reproduction)	32 (Growth)	100% C.d. 100% P.p.	Olver

Note: All above tests, reviewed in this technical review.

In addition to the above tests, the facility has completed several toxicity tests in accordance with permit requirements. This historical data is presented below in Table 2 and Table 3.

Table 2. (Acute Toxicity Tests)

Test Date	Test Organism	LC_{50} (%)	% Survival in 100% effluent	Testing Laboratory
03/1995	*P. promelas*	>100	NA	EnviroCompliance Laboratories
03/1995	*C. dubia*	>100	NA	EnviroCompliance Laboratories
06/1995	*P. promelas*	>100	NA	CVLC
06/1995	*C. dubia*	>100	NA	CVLC
09/1995	*P. promelas*	>100	NA	CVLC
09/1995	*C. dubia*	>100	NA	CVLC
12/1995	*P. promelas*	>100	NA	CVLC
12/1995	*C. dubia*	>100	NA	CVLC
03/1996	*P. promelas*	>100	NA	CVLC
03/1996	*C. dubia*	>100	NA	CVLC
03/1997	*P. promelas*	>100	NA	CVLC
03/1998	*P. promelas*	>100	NA	CVLC
03/1999	*P. promelas*	>100	NA	CVLC
03/2000*	*P. promelas*	>100	90	CVLC
03/2001*	*P. promelas*	>100	95	CVLC
03/2002*	*C. dubia*	>100	100	CBI

Table 3. Historical Chronic Toxicity Test Data

Test Date	**Vertebrate (*P. promelas*) NOEC%/TUc Value**	**Invertebrate (*C. dubia*) NOEC%/TUc Value**	**% Survival in 100% Effluent**	**IC25 as %**	**Endpoint**
3/1995	100% TUc=1.0		NA	NA	ND
3/1995		100% TUc=1.0	NA	NA	ND
6/1995	100% TUc=1.0		NA	NA	ND
6/1995		15% TUc=6.66	NA	NA	Reproduction
9/1995	100% TUc=1.0		NA	NA	ND
9/1995		25% TUc=4.0	NA	NA	Reproduction
12/1995	100% TUc=1.0		NA	NA	ND
12/1995		100% TUc=1.0	NA	NA	ND
3/1996	100% TUc=1.0		NA	NA	ND
3/1996		100% TUc=1.0	NA	NA	ND
3/1997		100% TUc=1.0	NA	NA	ND
3/1998		100% TUc=1.0	NA	NA	ND
3/1999		100% TUc=1.0	NA	NA	ND
3/2000*		100% TUc=1.0	100	NA	ND
3/2001*		100% TUc=1.0	100	>100	ND
3/2002*		100% TUc=1.0	100	>100	ND
7/2003*		100% TUc=1.0	100	>100	ND
3/2004*		100% TUc=1.0	100	>100	ND

NA = Not Available, ND = Not Determinable

3/1995 tests conducted by EnviroCompliance Laboratories, 6/95-3/01 tests conducted by CVLC, 3/02-03/04 tests conducted by CBI.

Discussion

The facility is currently undergoing a significant upgrade to control the discharge of Total Nitrogen and Total Phosphorus. As part of this upgrade, operational changes and new chemical use, have and will continue, to be employed. As part of the Chesapeake Bay nutrient reduction initiative, the facility must meet technology-based concentration and loading limitations by January 1, 2011. It is anticipated that the current and ongoing operational changes at the facility will change effluent composition. Based on this, it is recommended that future toxicity assessments be restricted to data generated after completion of the treatment upgrades. The current data seem to indicate a potential increase in chronic effluent toxicity, however, not at concentrations predictive of instream toxicity. Additionally, the reduced NOECs may be associated with acclimation of the plant biomass experienced as part of the upgrade indicated by effluent monitoring. However, at this time, no test results have resulted in a NOEC value less than the current endpoint of 10%.

Critical Flows in the Appomattox were reassessed during this reissuance and found to have decreased with incorporation of the 2002 drought record. The resulting critical flows are as follow:

1Q10 = 9.69 MGD
7Q10 = 12.28 MGD

Based on this change in critical receiving stream flow values, it was necessary to reassess the TMP special condition endpoints. The new values, along with mix results from Mix210.exe, were input into WETLIM10.xls (revision date 01/10/05) and the resultant endpoint was calculated as an NOEC = 12%. Current data indicate compliance with this endpoint so the slight revision is not anticipated to present a compliance problem for the facility.

Since the facility is undergoing significant changes, expected to last until 2011, it is recommended that continued annual chronic toxicity compliance monitoring be continued until the plant has completed the upgrade and stabilized. Since changes in treatment can influence effluent toxicity, whole effluent toxicity re-characterization of outfall 001 effluent will be necessary post upgrade. Four sets of acute and chronic tests are adequate for toxicity re-characterization.

Recommendations

1) Based on the above discussion, it is recommended that annual compliance chronic toxicity tests continue with the reissued permit until the plant has completed its' upgrade and has stabilized.

2) Acute and chronic toxicity tests should employ paired tests using both a vertebrate and invertebrate indicator organism (as indicated).

3) The chronic tests should utilize a dilution series predictive of toxicity at a 12% effluent concentration. A suggested monitoring series may be found in the Attached WETLIM spreadsheet in Table 4.

4) A TMP special condition, in accordance with the above is attached for inclusion in the subject reissued permit.

(?). TOXICS MANAGEMENT PROGRAM

1. Biological Monitoring:

a. In accordance with the schedule in 3. below, the permittee shall conduct annual chronic toxicity tests using 24-hour flow-proportioned composite samples of final effluent from outfall 001.

The chronic tests to use are:

Chronic 7-Day Static Renewal Survival and Growth Test using *Pimephales promelas.*
Chronic 3-Brood Static Renewal Survival and Reproduction Test using *Ceriodaphnia dubia.*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. Results which cannot be determined (i.e., a "less than" NOEC value) are not acceptable, and a retest will have to be performed. Express the test NOEC as TU_c (Chronic Toxic Units), by dividing 100/NOEC for DMR reporting. Report the LC_{50} at 48 hours and the IC_{25} with the NOEC's in the test report.

b. The permittee may provide additional chronic tests to address data variability during the period of data generation. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

c. The test dilutions should be able to determine compliance with the following endpoints:

(1) Chronic NOEC of 10% effluent which is equivalent to a TU_c of 12.00.

d. The test data will be evaluated by STATS.EXE for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should evaluation of the data indicate that a limit is needed, a WET limit and compliance schedule will be required and the toxicity tests of 1.a. may be discontinued.

2. Biological Monitoring:

a. In accordance with the schedule in 3. below, the permittee shall conduct four sets of quarterly acute and chronic toxicity tests using 24-hour flow-proportioned composite samples of final effluent from outfall 001. The acute multi-dilution NOAEC tests to use are:

48-Hour Static Acute test using *Ceriodaphnia dubia*
48-Hour Static Acute test using *Pimephales promelas*

These acute tests are to be conducted using 5 geometric dilutions of effluent with a minimum of 4 replicates, with 5 organisms in each. The NOAEC (No Observed Adverse Effect Concentration), as determined by hypothesis testing, shall be reported. The LC_{50} should also be determined and noted on the submitted report. Tests in which control survival is less than 90% are not acceptable.

The chronic tests to use are:

Chronic 3-Brood Static Renewal Survival and Reproduction Test using *Ceriodaphnia dubia*
Chronic 7-Day Static Renewal Survival and Growth Test using *Pimephales promelas*

These chronic tests shall be conducted in such a manner and at sufficient dilutions (minimum of five dilutions, derived geometrically) to determine the "No Observed Effect Concentration" (NOEC) for survival and reproduction or growth. Results which cannot be quantified (i.e., a "less than" NOEC value) are not acceptable, and a retest will have to be performed. Express the test NOEC as TU_c (Chronic Toxic Units), by dividing 100/NOEC for reporting. Report the LC_{50} at 48 hours and the IC_{25} with the NOEC's in the test report.

The permittee may provide additional samples to address data variability. These data shall be reported and may be included in the evaluation of effluent toxicity. Test procedures and reporting shall be in accordance with the WET testing methods cited in 40 CFR 136.3.

b. The test dilutions should be able to determine compliance with the following endpoints:

(1) Acute NOAEC = 100%

(2) Chronic NOEC of 12% equivalent to a TU_c of 8.33.

c. The test data will be evaluated by WLA.EXE for reasonable potential at the conclusion of the test period. The data may be evaluated sooner if requested by the permittee, or if toxicity has been noted. Should evaluation of the data indicate that a limit is needed, a WET limit and compliance schedule will be required and the toxicity tests of 2.a. may be discontinued.

d. If after evaluating the data, it is determined that no limit is needed, the permittee shall continue acute and chronic toxicity testing (both species) of the outfall annually, as on the reporting schedule in 3.

e. All applicable data will be reevaluated for reasonable potential at the end of the permit term.

3. Reporting Schedule:

The permittee shall supply 2 copies of the toxicity test reports specified in this Toxics Management Program in accordance with the following schedule:

Period	Compliance Periods	DMR/Report Submission
Annual 1	Permit Effective Date to 12/31/10	2/10/11
Annual 2	1/1/11 to 12/31/11	2/10/12
1st Qrtly	1/1/12 to 3/31/12	5/10/12
2nd Qrtly	4/1/12 to 6/30/12	8/10/12
3rd Qrtly	7/1/12 to 9/30/12	11/10/12
4th Qrtly	10/1/12 to 12/31/12	2/10/13
Annual 1	1/1/13 to 12/31/13	2/10/14
Annual 2	1/1/14 to 12/31/14	1/10/15

Spreadsheet for determination of WET test endpoints or WET limits

Excel 97
Revision Date: 06/07/04
File: WETLIM10.xls
(MIX.EXE required also)

Acute Endpoint/Permit Limit — **Use as LC_{50} in Special Condition, as TUa on DMR**

ACUTE	100% =	NOAEC	LC_{50} =	NA	% Use as	NA	TUa
ACUTE WLAa	1.19693063	Note: Inform the permittee that if the mean of the data exceeds this TUa:	1.0	a limit may result using WLA.EXE			

Chronic Endpoint/Permit Limit — **Use as NOEC in Special Condition, as TUc on DMR**

CHRONIC	8.946081817	TU_c	NOEC =	12	% Use as	8.33	TU_c
BOTH*	11.96930654	TU_c	NOEC =	9	% Use as	11.11	TU_c
AML	8.946081817	TU_c	NOEC =	12	% Use as	8.33	TU_c

ACUTE WLAa,c	11.9693063	Note: Inform the permittee that if the mean of the data exceeds this TUc:	3.67634465
CHRONIC WLAc	6.11666667	a limit may result using WLA.EXE	

* Both means acute expressed as chronic

Enter data in the cells with blue type:

Entry Date:	12/07/09		
Facility Name:	Farmville WWTP		
VPDES Number:	VA0083135		
Outfall Number:	1		
		% Flow to be used from MIX.EXE	**Difuser /modeling study?**
Plant Flow:	2.4 MGD		Enter Y/N N
Acute 1Q10:	9.69 MGD	74.05 %	Acute 1 :1
Chronic 7Q10:	12.28 MGD	100 %	Chronic 1 :1

Are data available to calculate CV? (Y/N)	N	(Minimum of 10 data points, same species, needed)	Go to Page 2
Are data available to calculate ACR? (Y/N)	N	(NOEC<LC50, do not use greater/less than data)	Go to Page 3

IWC_a	25.0641093 %	Plant flow/plant flow + 1Q10	**NOTE: If the IWCa is >33%, specify the NOAEC = 100% test/endpoint for use**
IWC_c	16.3487738 %	Plant flow/plant flow + 7Q10	
Dilution, acute	3.98976875	100/IWCa	
Dilution, chronic	6.11666667	100/IWCc	
WLA_a	1.19693063	Instream criterion (0.3 TUa) X's Dilution, acute	
WLA_c	6.11666667	Instream criterion (1.0 TUc) X's Dilution, chronic	
$WLA_{a,c}$	11.9693063	ACR X's WLA_a - converts acute WLA to chronic units	
ACR -acute/chronic ratio	10	LC50/NOEC (Default is 10 - if data are available, use tables Page 3)	
CV-Coefficient of variation	0.6	Default of 0.6 - if data are available, use tables Page 2)	
Constants eA	0.4109447	Default = 0.41	
eB	0.6010373	Default = 0.60	
eC	2.4334175	Default = 2.43	
eD	2.4334175	Default = 2.43 (1 samp)	

**The Maximum Daily Limit is calculated from the lowest LTA, X's eC. The LTAa,c and MDL using it are driven by the ACR.

$LTA_{a,c}$	4.91872297	WLAa,c X's eA					Rounded NOEC's	%
LTA_c	3.67634482	WLAc X's eB						
MDL** with $LTA_{a,c}$	11.9693065	TU_c	NOEC =	8.354703	(Protects from acute/chronic toxicity)		NOEC = 9	%
MDL** with LTA_c	8.94608182	TU_c	NOEC =	11.178078	(Protects from chronic toxicity)		NOEC = 12	%
AML with lowest LTA	8.94608182	TU_c	NOEC =	11.178078	Lowest LTA X's eD		NOEC = 12	

IF ONLY ACUTE ENDPOINT/LIMIT IS NEEDED, CONVERT MDL FROM TU_c to TU_a

							Rounded LC50's	%
MDL with $LTA_{a,c}$	1.19693065	TU_a	LC50 =	83.547029	%		LC50 = 84	%
MDL with LTA_c	0.89460818	TU_a	LC50 =	111.780780	%	Use NOAEC=100%	LC50 = NA	

Page 2 - Follow the directions to develop a site specific CV (coefficient of variation)

IF YOU HAVE AT LEAST 10 DATA POINTS THAT ARE QUANTIFIABLE (NOT "<" OR ">") FOR A SPECIES, ENTER THE DATA IN EITHER COLUMN "G" (VERTEBRATE) OR COLUMN "J" (INVERTEBRATE). THE 'CV' WILL BE PICKED UP FOR THE CALCULATIONS BELOW. THE DEFAULT VALUES FOR eA, eB, AND eC WILL CHANGE IF THE 'CV' IS ANYTHING OTHER THAN 0.6.

Coefficient of Variation for effluent tests

CV = 0.6 (Default 0.6)

δ^2 = 0.3074847

δ = 0.55451303

Using the log variance to develop eA

(P. 100, step 2a of TSD)

Z = 1.881 (97% probability stat from table

A = -0.8892967

eA = 0.41094469

Using the log variance to develop eB

(P. 100, step 2b of TSD)

δ_4^2 = 0.0861777

δ_4 = 0.29356038

B = -0.5090982

eB = 0.60103733

Using the log variance to develop eC

(P. 100, step 4a of TSD)

δ^2 = 0.3074847

δ = 0.55451303

C = 0.88929666

eC = 2.43341753

Using the log variance to develop eD

(P. 100, step 4b of TSD)

n = 1 This number will most likely stay as "1", for 1 sample/month.

δ_n^2 = 0.3074847

δ_n = 0.55451303

D = 0.88929666

eD = 2.43341753

	Vertebrate IC_{25} Data or LC_{50} Data	LN of data	Invertebrate IC_{25} Data or LC_{50} Data	LN of data
	**********		**********	
1	0		0	
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				
19				
20				
St Dev	NEED DATA	NEED DATA	St Dev	NEED DATA / NEED DATA
Mean	0	0	Mean	0 / 0
Variance	0	0.000000	Variance	0 / 0.000000
CV	0		CV	0

Page 3 - Follow directions to develop a site specific ACR (Acute to Chronic Ratio)

To determine Acute/Chronic Ratio (ACR), insert usable data below. Usable data is defined as valid paired test results, acute and chronic, tested at the same temperature, same species. The chronic NOEC must be less than the acute LC_{50}, since the ACR divides the LC_{50} by the NOEC. LC_{50}'s >100% should not be used.

Table 1. ACR using Vertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Table 1. Result:	Vertebrate ACR	0
Table 2. Result:	Invertebrate ACR	0
	Lowest ACR	Default to 10

Table 2. ACR using Invertebrate data

Set #	LC_{50}	NOEC	Test ACR	Logarithm	Geomean	Antilog	ACR to Use
1	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
2	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
3	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
4	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
5	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
6	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
7	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
8	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
9	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
10	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	NO DATA
				ACR for vertebrate data:			0

Table 3. Convert LC_{50}'s and NOEC's to Chronic TU's for use in WLA.EXE

ACR used: 10

	Enter LC_{50}	TUc	Enter NOEC	TUc
1		NO DATA		NO DATA
2		NO DATA		NO DATA
3		NO DATA		NO DATA
4		NO DATA		NO DATA
5		NO DATA		NO DATA
6		NO DATA		NO DATA
7		NO DATA		NO DATA
8		NO DATA		NO DATA
9		NO DATA		NO DATA
10		NO DATA		NO DATA
11		NO DATA		NO DATA
12		NO DATA		NO DATA
13		NO DATA		NO DATA
14		NO DATA		NO DATA
15		NO DATA		NO DATA
16		NO DATA		NO DATA
17		NO DATA		NO DATA
18		NO DATA		NO DATA
19		NO DATA		NO DATA
20		NO DATA		NO DATA

If WLA.EXE determines that an acute limit is needed, you need to convert the TUc answer you get to TUa and then an LC50,

enter it here:	NO DATA	$\%LC_{50}$
	NO DATA	TUa

DILUTION SERIES TO RECOMMEND

Table 4.

	Monitoring		Limit	
	% Effluent	TUc	% Effluent	TUc
Dilution series based on data mean	27.2	3.6763446		
Dilution series to use for limit			12	8.3333333
Dilution factor to recommend:	0.5215451		0.3464102	
Dilution series to recommend:	100.0	1.00	100.0	1.00
	52.2	1.92	34.6	2.89
	27.2	3.68	12.0	8.33
	14.2	7.05	4.2	24.06
	7.40	13.52	1.4	69.44
Extra dilutions if needed	3.86	25.91	0.5	200.47
	2.01	49.69	0.2	578.70

Cell: I9
Comment:
This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: K18
Comment: This is assuming that the data are Type 2 data (none of the data in the data set are censored - "<" or ">").

Cell: J22
Comment: Remember to change the "N" to "Y" if you have ratios entered, otherwise, they won't be used in the calculations.

Cell: C40
Comment:
If you have entered data to calculate an ACR on page 3, and this is still defaulted to "10", make sure you have selected "Y" in cell E21

Cell: C41
Comment: If you have entered data to calculate an effluent specific CV on page 2, and this is still defaulted to "0.6", make sure you have selected "Y" in cell E20

Cell: L48
Comment:
See Row 151 for the appropriate dilution series to use for these NOEC's

Cell: G62
Comment:
Vertebrates are:
Pimephales promelas
Oncorhynchus mykiss
Cyprinodon variegatus

Cell: J62
Comment:
Invertebrates are:
Ceriodaphnia dubia
Mysidopsis bahia

Cell: C117
Comment: Vertebrates are:

Pimephales promelas
Cyprinodon variegatus

Cell: M119
Comment: The ACR has been picked up from cell C34 on Page 1. If you have paired data to calculate an ACR, enter it in the tables to the left, and make sure you have a "Y" in cell E21 on Page 1. Otherwise, the default of 10 will be used to convert your acute data.

Cell: M121
Comment: If you are only concerned with acute data, you can enter it in the NOEC column for conversion and the number calculated will be equivalent to the TUa. The calculation is the same: 100/NOEC = TUc or 100/LC50 = TUa.

Cell: C138
Comment: Invertebrates are:

Ceriodaphnia dubia
Mysidopsis bahia